# TITLE OF THE INVENTION

VIDEO CAMERA APPARATUS

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the

5  benefit of priority from the prior Japanese Patent

Application No. 2000-170525, filed June 7, 2000, the

entire contents of which are incorporated herein by

reference.

## BACKGROUND OF THE INVENTION

10  The present invention relates to a video camera

apparatus and, more particularly, to a video camera

apparatus for recording a video signal obtained by

video shooting after encoding it by a compression-

encoding scheme such as MPEG4.

15  In recent years, a technique of transmitting still

video data obtained by video shooting using a digital

camera to a partner destination via the Internet has

been developed along with the spread of digital cameras

and the development of the Internet technique.

20  Recently, demands are arising for real time

transmission of not only still video data but also

motion video data via the Internet.  A streaming

reproduction technique is known as a real time

transmission system for motion video data.  According

25  to this technique, a motion video file compression-

encoded at a low bit rate is accumulated in a server

computer in advance, and the accumulated motion video

file is reproduced on each home computer via the
Internet in real time while being transferred.

To create a motion video file usable in the
streaming reproduction technique requires a dedicated
encoding device, a file generating device, and the
like. Video data obtained by video shooting using
a home digital camera cannot be directly utilized for
streaming reproduction.

More specifically, in recent years, various home
digital video cameras (DV cameras) coping with a DV
format and the like have been developed on the
assumption that such video camera is to obtain high
quality motion video data to be reproduced and watched
on a TV or VCR. Since motion video data is always
recorded with the highest quality of the camera, motion
video data in the DV format cannot be directly used for
real time transmission via a low bit rate communication
channel.

Hence, it is desired to implement a video camera
capable of easily obtaining motion video data optimal
for communication via the Internet.

Known examples of the motion video data
compression-encoding scheme are MPEG2, MPEG4, and
MPEG7. Any of MPEG2, MPEG4, and MPEG7 performs high
efficiency compression using the correlation between
frames. This compression processing, however, requires
a high speed processor. Thus, a video camera which

must be equipped with a low-cost processor with low power consumption takes a long compression time and may not attain a target frame rate.  In this case, some frames are omitted in compression processing, and

5       a reproduced video becomes a jerky motion video.

Fixed point shooting for monitoring of a shop/factory/road, astronomical observation, or the like preferably adopts special shot (interval shot) of shooting one frame after a predetermined interval

10      time because an object to be shot does not move. An encoding scheme such as MPEG2, MPEG4, or MPEG7 adds real time information as a time stamp to each encoded frame.  Images obtained by interval shot every predetermined time are encoded as temporally successive

15      images.  If such encoded data are directly decoded and reconstructed, the images are reproduced using a time actually taken from the start to end of interval shot, and a wasteful reproduction time is consumed.

In general, a conventional DV camera can record

20      not only motion video but also speech at the same time. However, a mode in which only speech is recorded is not prepared.  Even if only speech is important, motion video has to be recorded, which wastefully consumes the recording capacity of a recording medium.

25      The conventional DV camera comprises a communication interface with a computer, but is only recognized as a camera by the computer.  For this reason, exchange

of motion video data between the camera and the
computer requires dedicated software.

It is an object of the present invention to
provide a video camera apparatus suitable for
5 compatibility with the Internet or a computer.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a video camera
apparatus comprising a solid state image sensor,
a motion video encoding section which performs
10 compression encoding including intra-frame encoding and
inter-frame encoding for a motion video signal input
from the solid state image sensor, a recording section
which records the motion video signal compression-
encoded by the motion video encoding section as a
15 motion video file on a recording medium, and a control
section which has a first motion video shooting and
recording mode for obtaining a motion video file
capable of transmitting the compression-encoded motion
video signal in real time to a partner destination via
20 a network, and controls the motion video encoding
section so as to match a bit rate of an encoded signal
obtained by the motion video encoding section with a
communication speed of the network used to transmit the
motion video file when the first motion video shooting
25 and recording mode is selected.

This video camera apparatus has the first motion
video shooting and recording mode for obtaining

a motion video file capable of transmitting the compression-encoded motion video signal in real time to a partner destination via a network. When the first motion video shooting and recording mode is selected, the bit rate of an encoded signal is automatically set to match with the communication speed of a network used to transmit the motion video file. The user can easily obtain a motion video file suitable for video transmission via the Internet or the like by only selecting the first motion video shooting and recording mode.

When the first motion video shooting and recording mode is selected, the bit rate of an encoded signal obtained by a speech signal encoding section is also preferably automatically set to match with the communication speed of the network used to transmit the motion video file.

A second motion video shooting and recording mode in which an encoded signal having a higher bit rate than in the first motion video shooting and recording mode is recorded as a motion video file is prepared in addition to the first motion video shooting and recording mode. When the second motion video shooting and recording mode is selected, the bit rate of an encoded signal obtained by the motion video encoding section is automatically controlled to be higher than in the first motion video shooting and recording mode. To obtain a high quality motion video file to be played

back on a TV or the like, the user selects the second
motion video shooting and recording mode; and to
obtain a motion video file to be communicated via
the Internet, he/she selects the first motion video
5     shooting and recording mode. With this operation,
the user can easily attain a motion video file having
an image quality (bit rate) coping with the application
purpose.

     The video camera apparatus further comprises
10    an option selection section which selects an encoding
option to be executed by the motion video encoding
section. When an encoding delay by the motion video
encoding section is detected, encoding by the motion
video encoding section is switched to intra-frame
15    encoding, and the motion video encoding section is
caused to omit inter-frame encoding (e.g., motion
detection or motion compensation). This can implement
encoding at a target frame rate. Alternatively,
encoding may be switched to intra-frame encoding on the
20    basis of the motion vector size or the amount of hand
blurring.

    In an interval shot mode in which image sensing
and recording of one or more frames are repetitively
executed after a predetermined interval time, it is
25    desirable to switch encoding by the motion video
encoding section to intra-frame encoding, and cause
the motion video encoding section to omit inter-frame

encoding.

In the interval shot mode, the time stamp value
of each frame added to the compression-encoded motion
video signal recorded as the motion video file is
5   displaced by another virtual value.  Thus, the motion
video file obtained by interval shot can be efficiently
reproduced.

The video camera apparatus has a speech recording
mode in which only a speech signal is recorded.
10  In this speech recording mode, at least the solid state
image sensor and the motion video encoding section are
set to an OFF or standby state.  In this case, the
video camera apparatus can also be used as a so-called
IC voice recorder.  In particular, wasteful battery
15  consumption can be suppressed by setting circuits other
than a portion concerning speech recording to an OFF or
standby state.  As a result, long time speech recording
can be realized.

The video camera apparatus further comprises
20  an index image generation section which generates the
index image of the motion video signal recorded as the
motion video file on the basis of a predetermined one-
frame video signal obtained from the solid state image
sensor, and record the index image on the recording
25  medium.  The contents of each motion video file on the
recording medium can be easily estimated from its index
image.

The video camera apparatus further comprises a communication interface which connects the video camera apparatus to an information processing device, a recognition section which causes the information

5    processing device to recognize the video camera apparatus as a storage device when the video camera apparatus is connected to the information processing device via the communication interface, and a control section which controls the recording medium of the

10    video camera apparatus in accordance with an access request from the information processing device to the storage device. Since the information processing device can treat the video camera apparatus as a storage device, motion video files between the

15    information processing device and the video camera apparatus can be easily exchanged.

Additional objects and advantages of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may

20    be learned by practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out hereinafter.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

25    The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate presently preferred embodiments of the

invention, and together with the general description given above and the detailed description of the preferred embodiments given below, serve to explain the principles of the invention.

5      FIG. 1 is a block diagram showing the arrangement of a video camera apparatus according to an embodiment of the present invention;

FIGS. 2A and 2B are views showing the outer appearance of the video camera apparatus according to

10     the embodiment;

FIG. 3 is a block diagram showing a bit rate switching functional arrangement in the video camera apparatus according to the embodiment;

FIG. 4 is a table for explaining the motion video

15     and Internet modes of the video camera apparatus according to the embodiment;

FIG. 5 is a table for explaining the motion video and Internet modes of the video camera apparatus and corresponding speech encoding schemes according to the

20     embodiment;

FIG. 6 is a flow chart showing a bit rate control processing sequence by the video camera apparatus according to the embodiment;

FIG. 7 is a block diagram showing the first

25     arrangement for switching a compression encoding option in the video camera apparatus according to the embodiment;

FIG. 8 is a block diagram showing the second arrangement for switching a compression encoding option in the video camera apparatus according to the embodiment;

FIG. 9 is a block diagram showing the third arrangement for switching a compression encoding option in the video camera apparatus according to the embodiment;

FIGS. 10A and 10B are views for explaining interval shot and time stamp displacement processing in the video camera apparatus according to the embodiment;

FIG. 11 is a table showing interval times usable in interval shot in the video camera apparatus according to the embodiment;

FIG. 12 is a block diagram showing the first functional arrangement concerning time stamp displacement in the video camera apparatus according to the embodiment;

FIG. 13 is a block diagram showing the second functional arrangement concerning time stamp displacement in the video camera apparatus according to the embodiment;

FIG. 14 is a block diagram showing the third functional arrangement concerning time stamp displacement in the video camera apparatus according to the embodiment;

FIG. 15 is a flow chart for explaining setting

processing in the interval shot mode executed by the video camera apparatus according to the embodiment;

FIG. 16 is a block diagram showing circuits operated when the video camera apparatus according to the embodiment is in a voice only mode;

FIGS. 17A and 17B are views showing an example of status display representing that the video camera apparatus according to the embodiment operates in the voice only mode;

FIGS. 18A and 18B are views showing an example of status display for the video shooting residual time in the video camera apparatus according to the embodiment;

FIGS. 19A and 19B are views showing an example of status display for the battery residual capacity in the video camera apparatus according to the embodiment;

FIG. 20 is a block diagram showing a functional arrangement for adding a beep sound to a speech signal and recording the speech signal in the video camera apparatus according to the embodiment;

FIGS. 21A and 21B are views showing an example of status display for the residual recordable number of still videos in the video camera apparatus according to the embodiment;

FIG. 22 is a flow chart showing a voice only mode setting processing sequence executed by the video camera apparatus according to the embodiment;

FIG. 23 is a block diagram showing a functional

arrangement for realizing an index generation function in the video camera apparatus according to the embodiment;

FIG. 24 is a view showing the relationship between a motion video file and index image recorded by the video camera apparatus according to the embodiment;

FIG. 25 is a view showing the relationship between the motion video shooting period and the index image in the video camera apparatus according to the embodiment;

FIGS. 26A and 26B are views each showing the use form of the index image in the video camera apparatus according to the embodiment;

FIG. 27 is a flow chart showing an index image generation processing sequence by the video camera apparatus according to the embodiment;

FIG. 28 is a block diagram showing a functional arrangement for using the video camera apparatus according to the embodiment as a storage device of a personal computer;

FIG. 29 is a block diagram showing circuits operated when the video camera apparatus according to the embodiment is connected to the personal computer;

FIG. 30 is a flow chart showing a processing sequence executed when the video camera apparatus according to the embodiment is connected to the personal computer; and

FIG. 31 is a flow chart showing a processing

sequence in activating the video camera apparatus according to the embodiment.

### DETAILED DESCRIPTION OF THE INVENTION

A preferred embodiment of the present invention will be described below with reference to the several views of the accompanying drawing.

FIG. 1 is a block diagram showing the arrangement of a motion video camera apparatus according to an embodiment of the present invention. A video camera apparatus 11 shoots an image to obtain a motion video signal, compression-encodes the motion video signal in an MPEG4 encoding format, and records the encoded signal as a motion video file on a recording medium. The video camera apparatus 11 has a still video shooting and recording mode in addition to a motion video shooting and recording mode.

As shown in FIG. 1, the video camera apparatus 11 comprises a zoom lens 111, CCD 112, video signal processor 113, still video compression/decompression section 114, motion video compression/decompression section 115, microphone 116, loudspeaker 117, speech compression/decompression section 118, control section (CPU) 119, LCD monitor 120, built-in flash memory 121, PCMCIA card type hard disk drive 122, and USB interface 123.

The zoom lens 111 constitutes a video shooting optical system. An optical image formed by the zoom

lens 111 is photoelectrically converted by the CCD 112
serving as a solid state image sensor.  The motion
video signal attained by photoelectric conversion is
converted into a digital signal by the video signal

5    processor 113.  After the digital signal undergoes
necessary video processing in the video signal
processor, the digital video signal is sent to the
still video compression/decompression section 114
in the still video shooting and recording mode and to

10   the motion video compression/decompression section 115
in the motion video shooting and recording mode.

The still video compression/decompression section
114 compression-encodes the input video signal in a
JPEG format.  The resultant encoded signal is recorded

15   as an encoded still video file on the built-in flash
memory 121 or PCMCIA card type hard disk drive 122 by
the control section 119.  The PCMCIA card type hard
disk drive 122 is larger in capacity than the built-in
flash memory 121, and is detachably mounted on the

20   video camera apparatus 11.  When the PCMCIA card type
hard disk drive 122 is mounted, the encoded still video
file is recorded on the PCMCIA card type hard disk
drive 122; and when the PCMCIA card type hard disk
drive 122 is not mounted, the file is recorded on

25   the built-in flash memory 121.  The still video
compression/decompression section 114 also has
a function of decompressing an encoded still video file

in the JPEG format. A video signal decompressed by the still video compression/decompression section 114 can be displayed on the LCD monitor 120 or a TV 12. The LCD monitor 120 is utilized not only as a reproduction

5    display but also as a display viewfinder for an input video signal to be compressed.

The motion video compression/decompression section 115 compression-encodes, in the MPEG4 format, motion video signals successively input via the CCD 112 and

10   video signal processor 113. Similar to MPEG2, MPEG4 is an encoding format having both the intra-frame encoding mode and inter-frame encoding mode, and uses a motion compensation prediction technique by motion vector detection (ME). Motion vector detection executes block

15   search processing of searching a reference frame for the most approximate block for each block of interest within an input frame. The spatial deviation between the searched block and the block of interest is calculated as a motion vector. The image of the input

20   frame is predicted from the reference frame on the basis of the motion vector, and the error signal between the predicted image and the input image is subjected to orthogonal transformation, quantization, and variable length encoding. This motion compensation

25   prediction technique realizes high efficiency compression encoding using the correlation between frames. Since the bit rate is lower in MPEG4 than in

MPEG2 for the same image quality, MPEG4 has a wider
usable bit rate and stronger error robustness.

The signal encoded by the motion video
compression/decompression section 115 is recorded as an
5   encoded motion video file in the built-in flash memory
121 or PCMCIA card type hard disk drive 122 by the
control section 119.  When the PCMCIA card type hard
disk drive 122 is mounted, the encoded motion video
file is recorded in the PCMCIA card type hard disk
10  drive 122; and when the PCMCIA card type hard disk
drive 122 is not mounted, the file is recorded in
the built-in flash memory 121.  The motion video
compression/decompression section 115 also has a
decoding function of decompressing an encoded motion
15  video file in the MPEG2/4 format.  A motion video
signal decompressed by the motion video compression/
decompression section 115 can be displayed on the LCD
monitor 120 or TV 12.  The LCD monitor 120 is utilized
not only as a reproduction display but also as a
20  display viewfinder for an input image signal to be
compressed.

The speech compression/decompression section 118
compresses and encodes a speech signal input via the
microphone 116, and performs decoding processing of
25  decompressing a compression-encoded speech file to
output the resultant speech.  In the motion video
shooting and recording mode, compression encoding of a

speech signal by the speech compression/decompression

section 118 is generally done at the same time.

In this case, an encoded motion video signal and

encoded speech signal are multiplexed by the control

5    section 119, and the multiplexed data is recorded as

an encoded motion video file.

The USB interface 123 is a communication interface

with an external information processor such as a

personal computer 13.   Encoded still video/motion video

10   files can be exchanged between the built-in flash

memory 121 or PCMCIA card type hard disk drive 122 and

the personal computer 13 via the USB interface 123.

Note that the PCMCIA card type hard disk drive 122 is

implemented as a PCMCIA card of type 2, and can be used

15   by being inserted into the PCMCIA card slot of the

personal computer 13.   An encoded motion video file

obtained by video shooting using the video camera

apparatus 11 is in the MPEG4 format, so that the motion

video can be smoothly transmitted from the personal

20   computer 13 to the Internet.

FIGS. 2A and 2B show the outer appearance of

the video camera apparatus 11.   FIG. 2A shows a state

in which the LCD monitor 120 is stored at a closed

position such that the display surface of the LCD

25   monitor 120 faces the back surface of the main body.

FIG. 2B shows a state in which the LCD monitor 120 is

opened from the closed position and rotated such that

the display surface can be observed from a direction indicated by the arrow.

The main body of the video camera apparatus 11 has various operation buttons concerning video shooting, reproduction, setting of the operation mode, and the like. The above-mentioned zoom lens 111 is attached to the lens barrel. The LCD monitor 120 is attached to the back surface of the main body, and a PCMCIA card slot for inserting the PCMCIA card type hard disk drive 122 is also formed in the back surface of the main body.

<Video Mode and Internet Mode>

Two video shooting/recording modes set in the video camera apparatus 11 of this embodiment will be explained.

The video camera apparatus 11 has two video shooting/recording modes, i.e., video mode (VIDEO MODE) and Internet mode (INTERNET MODE). The video mode is a mode for shooting a high quality motion video, and is mainly used to obtain an encoded motion video file to be reproduced and displayed on the TV 12 or personal computer 13. The Internet mode is a mode for obtaining an encoded motion video file having a low bit rate that is suitable for real time transfer of a motion video via the Internet. The user can properly select the video mode and Internet mode with an operation button. When the video mode is selected, motion video

compression encoding at a high bit rate that is

necessary to attain high quality is executed. When the

Internet mode is selected, the target bit rate of

motion video compression encoding is automatically

5      switched to a value optimal for real time transfer of

a motion video via the Internet. An arrangement for

switching the bit rate in accordance with selection of

the video mode/Internet mode is shown in FIG. 3.

As shown in FIG. 3, the control section 119

10     comprises a bit rate designation section 301. The bit

rate designation section 301 variably sets the target

bit rate in accordance with the application purpose of

an encoded motion video file obtained in the motion

video shooting and recording mode. If the video mode

15     is selected by the operation button, the bit rate

designation section 301 designates the first target bit

rate with respect to an MPEG4 encoder 201 arranged in

the motion video compression/decompression section 115.

The MPEG4 encoder 201 executes motion video compression

20     encoding so as to obtain an encoded bit stream having

the designated target bit rate. If the Internet mode

is selected by the operation button, the bit rate

designation section 301 designates the second target

bit rate (second target bit rate < first target bit

25     rate) with respect to the MPEG4 encoder 201 arranged in

the motion video compression/decompression section 115.

The MPEG4 encoder 201 executes motion video compression

encoding so as to obtain an encoded bit stream having the designated target bit rate. The bit rate of the encoded bit stream can be controlled by, e.g., adjusting the quantization step size and changing the

5  number of allocation bits.

An encoded bit stream (MPEG4 bit stream) output from the MPEG4 encoder 201 is input to the control section 119 where the bit stream is converted into, e.g., an ASF (Advanced Streaming Format) file format.

10  The converted bit stream is recorded on the recording medium (built-in flash memory 121 or PCMCIA card type hard disk drive 122). The ASF file format is used to provide multimedia data as streaming data via a network, and can include not only videos but also

15  speech and texts in the same ASF file data.
<Bit Rate>

FIG. 4 shows the relationship between the video mode (VIDEO MODE) and Internet mode (INTERNET MODE), and corresponding bit rates. In the video mode, as

20  shown in FIG. 4, three resolutions VGA (640 × 480), QVGA (320 × 240), and QQVGA (160 × 120) can be used. For each resolution, high image quality (FINE) and normal image quality (NORMAL) can be selected. In the Internet mode, two resolutions QVGA (320 × 240) and

25  QQVGA (160 × 120) can be used. For each resolution, high image quality (FINE) and normal image quality (NORMAL) can be selected.

When the user selects FINE of QVGA (320 × 240),
the bit rate is set to 768 kbps in the video mode, but
is switched to a lower rate of 128 kbps in the Internet
mode.  The bit rate of 128 kbps corresponds to the
5      maximum transfer rate of an ISDN network.  Even for the
same resolution, the bit rate is automatically changed
between the video mode and the Internet mode.  A bit
rate conforming to the communication speed of a network
is always set in the Internet mode.

10     <Bit Rate Control of Speech Signal>

Bit rate control of a speech signal in the motion
video shooting and recording mode will be described.

In this embodiment, the bit rate is controlled
even for a speech signal in addition to a motion video
15     signal so as to change the bit rate between the video
mode and the Internet mode.  That is, the control
section 119 designates, to the speech compression/
decompression section 118, encoding at a high bit rate
for high speech quality in the video mode, and encoding
20     at a low bit rate in accordance with the communication
speed of a network in the Internet mode.

FIG. 5 shows the relationship between the video
and Internet modes, and speech compression encoding
systems used in these modes.

25     The bit rate of a speech signal in the Internet
mode can be decreased by switching the speech
compression encoding system such that the video mode

uses a G.723 encoding system and the Internet mode uses a G.729 encoding system lower in bit rate than the G.723 standard. When a speech compression encoding system such as AAC or MP3 is used, the bit rate can be variably set in this speech compression encoding, and can be controlled such that a high bit rate for high speech quality is designated in the video mode and a low bit rate is designated in accordance with the communication speed of a network in the Internet mode.

The flow chart of FIG. 6 shows a bit rate control processing sequence by the control section 119.

The control section 119 determines whether a motion video shooting and recording mode designated by the user is the video mode or the Internet mode (step S101). If the motion video shooting and recording mode is the video mode (VIDEO), the control section 119 designates to the motion video compression/decompression section 115 a target bit rate for the video mode that corresponds to the current resolution and image quality FINE/NORMAL designated by the user, and sets the bit rate of motion video encoding to a high bit rate for high image quality (step S102). The control section 119 selects high bit rate speech encoding, and designates it to the speech compression/decompression section 118 (step S103). If the motion video shooting and recording mode is the Internet mode (INTERNET), the control section 119 designates to the

motion video compression/decompression section 115 a target bit rate for the Internet mode that corresponds to the current resolution and image quality FINE/NORMAL designated by the user, and sets the bit rate of motion video encoding to a low bit rate for network transmission (step S104). The control section 119 selects low bit rate speech encoding, and designates it to the speech compression/decompression section 118 (step S105).

In this embodiment, the bit rate in the Internet mode is determined based on the designated resolution and designated image quality. It is also possible that the user selects the communication speed or type of network to be used, and a corresponding resolution and bit rate are automatically set.

<Option Control of Motion Image Compression Encoding>

Control of automatically selecting a motion video compression encoding option will be explained with reference to FIGS. 7 to 9.

In general, a motion video compression encoding device is designed to attain the highest image quality at a designated bit rate. This motion video compression encoding device requires a high speed processor. A home digital video camera must satisfy low cost and low power consumption, so it is difficult to use such a high speed processor. To realize motion video compression encoding at a frame rate at which

a relatively low speed processor is enough to implement
the motion video compression/decompression section 115,
this embodiment has the following automatic option
selection functions.

5        ·When encoding by the motion video compression/
decompression section 115 delays, a compression
encoding option is automatically switched to an option
smaller in processor load.

         ·Motion video encoding is switched to intra-frame
10    encoding on the basis of the motion vector size or
the amount of hand blurring, and the motion video
compression/decompression section 115 omits inter-frame
encoding (e.g., motion detection or motion
compensation).

15       Detailed control will be described.

         FIG. 7 shows an arrangement for switching
a compression encoding option on the basis of an
encoding delay.

         The MPEG4 encoder 201 comprises a processing
20    time computation section 201a.  The processing time
computation section 201a computes a time (processing
time) taken by the MPEG4 encoder 201 for compression
encoding per frame.  The processing time value is sent
to a delay time computation section 401 arranged in
25    the control section 119.  The delay time computation
section 401 uses the time information from a timer in
the video camera 11 to sequentially compute an average

processing time up to the present taken for compression

encoding per frame, and compares the average processing

time with a designated target frame rate (e.g., 30 fps)

to obtain an encoding delay time.  When the delay time

5    increases to a value at which encoding at the target

frame rate becomes impossible, the delay time

computation section 401 sends the delay time at that

time to an option selection section 402 arranged in the

control section 119.

10    The option selection section 402 selects and

designates a compression encoding option to be executed

with respect to the MPEG4 encoder 201, and has a table

representing the improvement amount of a processing

time attained when each of options determined as

15    compression encoding optional functions is enabled/

disabled.  The improvement amount of the table is based

on a value measured in advance.  The option selection

section 402 switches the compression encoding option

based on the delay time so as to reduce the computation

20    amount of the processor by an amount corresponding to

the input delay time.  More specifically, the option

selection section 402 selects an option in which

compression encoding by the MPEG4 encoder 201 is

switched to intra-frame encoding and the MPEG4 encoder

25    201 is caused to temporarily omit inter-frame encoding

(e.g., motion detection or motion compensation).

An arbitrary option can be switched in accordance with

the MPEG4 standard as far as the option is switched to
decrease the computation amount.

FIG. 8 shows an arrangement for switching a
compression encoding option on the basis of a motion
5    vector size.

In this embodiment, the control section 119
incorporates a motion vector size computation section
403 in addition to the delay time computation section
401 and option selection section 402.  The motion
10   vector size computation section 403 checks a motion
vector value obtained by motion vector detection
processing by the MPEG4 encoder 201, and when the
motion vector value exceeds a predetermined value,
instructs the option selection section 402 to switch
15   an option.  In response to the option switching
instruction from the motion vector size computation
section 403, the option selection section 402 selects
an option in which compression encoding by the MPEG4
encoder 201 is switched to intra-frame encoding and
20   the MPEG4 encoder 201 is caused to temporarily omit
inter-frame encoding (e.g., motion detection or motion
compensation).

Generally when the background and object hardly
move in an input image, the error between a predicted
25   image and the input image is small, inter-frame
compression processing can be performed at high
efficiency, and the processing time does not influence

the frame rate. To the contrary, when the user holds the video camera apparatus 11 to shoot a motion video, the image correlation between frames decreases owing to hand blurring, pan, zoom, or short cut-in, and the

5 motion between frames cannot be detected. In this case, the error between a predicted image and an input image increases, and encoding requires a large computation amount. Processing such as motion detection or motion compensation becomes eventually

10 useless to waste an extra calculation amount. In this case, the option selection section 402 switches the encoding mode to the intra-frame encoding mode to temporarily stop motion detection/motion compensation processing. This can reduce the computation amount.

15 FIG. 9 shows an arrangement for switching a compression encoding option on the basis of the amount of hand blurring.

In this embodiment, the compression encoding option is switched based on a signal from a hand

20 blurring detector 501 arranged in the video camera apparatus 11. The hand blurring detector 501 is formed from, e.g., a dedicated sensor, and when detecting hand blurring of a predetermined value or more, instructs the option selection section 402 to switch the option

25 selection section 402. In response to the option switching instruction from the hand blurring detector 501, the option selection section 402 selects an option

in which compression encoding by the MPEG4 encoder 201
is switched to intra-frame encoding and the MPEG4
encoder 201 is caused to temporarily omit inter-frame
encoding (e.g., motion detection or motion

5   compensation).

<Interval Shot>

An interval shot mode (interval REC) used in this
embodiment will be explained.

The interval shot mode is a motion video shooting/
10  recording mode for fixed point shooting that is used
for monitoring of a shop/factory/road, astronomical
observation, observation of a flower's growth, or the
like.  This interval shot mode can be used in both the
video and Internet modes.  In the interval shot mode,
15  an image can be shot and recorded for each frame or
several successive frames after a predetermined
interval time.  This state is shown in FIG. 10A.

FIG. 10A shows an example in which one frame is
shot every interval time.  After a 1-frame image (A1)
20  is captured from the CCD 112 and video signal processor
113, image capture is suspended for the interval time,
and a one-frame image (B1) is captured again upon the
lapse of the interval time.  Captured images A1, B1,
and C1 are images having different shooting times by
25  the interval time.  The images A1, B1, and C1 are input
to the MPEG4 encoder 201 at intervals corresponding to
the differences between the real shooting times of the

images.  In this case, a time stamp representing the real time is added for each encoded frame to a bit stream obtained by the MPEG4 encoder 201.  If the encoded file is directly decoded and reconstructed,

5  an image is undesirably reproduced using a time taken for actual video shooting.

To prevent this, as shown in FIG. 10B, this embodiment displaces the value of the time stamp (TS) of each frame added to a motion video signal recorded

10  as an encoded motion video file by another virtual value.  The encoded images A1, B1, and C1 are assigned time stamps TS1, TS2, and TS3 corresponding to a case wherein these images are temporally successive frames.

The interval time in the interval shot mode

15  includes three times, i.e., 5 sec, 10 sec, and 1 min, as shown in FIG. 11, and the user can select any of the times in accordance with the purpose of interval shot. To the contrary, the interval time is 1/30 sec in normal motion video shooting/recording.  Even if the

20  interval time of 5 sec, 10 sec, or 1 min is selected, the values of the time stamps TS1, TS2, and TS3 after displacement is delayed by 1/30 sec.

Displacement of the time stamp enables observing necessary motion video within a short time without

25  using special reproduction such as fast forward in reproducing an encoded motion video file.

FIG. 12 shows the first arrangement for displacing

a time stamp.

As shown in FIG. 12, the MPEG encoder 201 comprises a time stamp generator 201b, and the control section 119 comprises a time stamp displacement controller 403. The time stamp generator 201b normally generates as a time stamp a value corresponding to real encoding time for each encoded frame, and the time stamp value is displaced by another virtual value by the operation of the time stamp displacement controller 403. Displacement of the time stamp is controlled by replacing the time stamp of an encoded frame with a value updated every 1/30 sec upon the lapse of every designated interval time.

FIG. 13 shows the second arrangement for displacing the time stamp.

In this example, before the time stamp of real time generated by the time stamp generator 201b is displaced by a virtual value, the generated time stamp of real time is transferred as a time information index to the control section 119, and an index file other than an encoded motion video file is generated. A time stamp to be added to a bit stream recorded as an encoded motion video file is displaced by a virtual value in accordance with the interval time, similar to FIG. 12. By referring to the contents of the index file, the user can easily recognize a frame and its real shooting time.

FIG. 14 shows the third arrangement for displacing the time stamp.

In this example, the time stamp of real time is synthesized as video information such as bit map information onto a frame, and encoded.  That is, the control section 119 comprises a timer 404 and bit map data output unit 405 in addition to the time stamp displacement controller 403.  The timer 404 supplies real time to the bit map data output unit 405 every interval time.  The bit map data output unit 405 generates video information representing real time from the timer 404, and outputs it to a synthesizer 601 connected to the input of the MPEG4 encoder 201.  It is also possible to prepare pieces of video information representing times for respective resolutions in the video camera apparatus 11 and output corresponding video information.

The synthesizer 601 synthesizes the video information from the bit map data output unit 405 onto a frame input every interval time, and outputs the synthesized image to the MPEG4 encoder 201, which encodes the frame to which the video information representing real time is synthesized.  A time stamp to be added to a bit stream recorded as an encoded motion video file is displaced by a virtual value in accordance with the interval time, similar to FIG. 12.

The flow chart of FIG. 15 shows a processing

sequence by the control section 119.

The control section 119 determines whether a motion video shooting and recording mode designated by the user is the interval shot mode (step S112).

5    If YES in step S112, the control section 119 sets the time stamp displacement controller 403 so as to displace a time stamp by a virtual value (step S112), and switches the encoding mode of the MPEG4 encoder 201 to the intra-frame encoding mode (step S113).  In this

10   state, the interval shot starts.  The intra-frame encoding mode is used in the interval shot mode in order to prevent an increase in the computation amount of encoding owing to wasteful processing such as motion detection and motion compensation.

15   <Voice Only Mode>

A voice only mode set in the video camera apparatus 11 of this embodiment will be described. The video camera apparatus 11 can be greatly downsized because it does not have any movable portion such as

20   a recording tape, unlike a DV camera.  The voice only mode is an operation mode for using the video camera apparatus 11 as a so-called IC recorder by utilizing the "downsizing" feature of the video camera apparatus 11.  In this mode, no motion or still videos are

25   recorded, and only speech is recorded.

FIG. 16 shows circuits used and not used in the voice only mode.  In the voice only mode, the

operations of circuits concerning input of video
signals such as still and motion videos, signal
processing, encoding, and display are set in an OFF or
standby state by stopping clocks, decreasing the clock
5   rate, or stopping power supply.  As represented by
oblique lines in FIG. 16, only circuits concerning
speech recording are set in an ON state.  This can
prolong the battery driving time of the video camera
apparatus 11, i.e., the continuous speech recording
10   time using the battery.

FIGS. 17A and 17B show an example of status
display in the voice only mode.  The video camera
apparatus 11 has a status display LED for the voice
only mode.  The LED is OFF in an operation mode such as
15   the motion video shooting and recording mode other than
the voice only mode, as shown in FIG. 17A, and is ON
(flickers at a predetermined time interval) in the
voice only mode, as shown in FIG. 17B.  Even if the LCD
monitor 120 is OFF, the user can confirm that the video
20   camera apparatus 11 operates in the voice only mode.

A display example and operation when the residual
capacity of the recording medium (built-in flash memory
121 or PCMCIA card type hard disk drive 122) becomes
small will be explained with reference to FIGS. 18A
25   and 18B.

FIG. 18A shows a state in which the LCD monitor
120 displays during motion video shooting that the

motion video shooting residual time is XXX sec, and

FIG. 18B is a display example of the LCD monitor 120

when the motion video shooting residual time is 0 sec.

When the motion video shooting residual time becomes

5    0 sec, this is displayed as shown in FIG. 18B, and

the operations of circuits concerning input of video

signals, signal processing, encoding, and display

processing are set to an OFF or standby state.

As shown in FIG. 16, only circuits concerning speech

10   recording operate, and speech signals smaller in data

amount than video signals are recorded as an emergency

workaround.  By automatically switching the operation

mode to the voice only mode, only speech signals can be

continuously recorded.

15       The same display and switching to the voice only

mode can be performed even when still videos are shot

(FIGS. 21A and 21B).

         FIGS. 19A and 19B show display examples when the

battery residual capacity becomes small.  FIG. 19A

20   shows a display example when the battery is fully

charged, and FIG. 19B shows a display example when the

battery level decreases to a level (low battery level)

in which motion and still video shooting and recording

cannot be continued.  If the battery level decreases

25   to the low battery level in the motion or still video

shooting mode, this is displayed as shown in FIG. 19B,

and the operations of circuits concerning input of

video signals, signal processing, encoding, and display processing are set in an OFF or standby state. As shown in FIG. 16, only circuits concerning speech recording operate, and speech signals smaller in data amount than video signals are recorded as an emergency workaround. By automatically switching the operation mode to the voice only mode in the low battery level, only speech signals can be continuously recorded.

An operation of adding a beep sound to an input speech signal and recording the resultant signal will be explained with reference to FIG. 20.

In recording only speech signals due to a small residual capacity of the recording medium or a small battery capacity, the control section 119 controls a beep sound generator 131a and adder 131b, and synthesizes a beep sound onto an input speech signal from the microphone 116 at a predetermined time interval. The input speech signal onto which the beep sound is synthesized is compression-encoded by the speech compression/decompression section 118, and recorded in a motion video file via the control section 119. If the user hears the added beep sound while listening to the reproduced speech, he/she can easily understand that the speech is recorded as an emergency workaround because of a small residual capacity of the recording medium or a small battery capacity, and that no long-time speech signals are subsequently recorded.

The flow chart of FIG. 22 shows a voice only mode processing sequence by the control section 119.

The control section 119 determines whether the user explicitly designates the voice only mode (step S121). If the user designates the voice only mode (YES in step S121), the control section 119 sets circuits not concerning speech recording in an OFF or periodical state (step S123), and records only speech signals (step S124). Even if NO in step S121, but a decrease in battery or the residual capacity of the recording medium is detected in the motion video shooting and recording mode (YES in step S122), the control section 119 sets circuits not concerning speech recording in an OFF or periodical state (step S123), and records only speech signals (step S124).

<Index Image of Encoded Video File>

Processing of generating the index image of a motion video signal recorded as an encoded motion video file and recording the index image on a recording medium will be described. In the video camera apparatus 11 of this embodiment, a motion video signal obtained by motion video shooting every time a motion video is shot is recorded as an encoded motion video file. An index image is recorded on the recording medium in correspondence with the encoded motion video file, which enables easily presenting to the user the contents of many encoded motion video files recorded on

the recording medium. An arrangement for generating

and recording the index image is shown in FIG. 23.

As shown in FIG. 23, the control section 119

comprises an index generator 406. The index generator

5    406 generates an VGA-size JPEG index file (DCF file) as

the index image of an encoded motion video file (ASF),

and records the index file on the recording medium

(built-in flash memory 121 or PCMCIA card type hard

disk drive 122) in correspondence with the encoded

10   motion video file (ASF). The index image is generated

from one frame of a motion video signal recorded as

the encoded motion video file (ASF). For example, the

first frame at the start of motion video shooting and

recording is stored in a frame memory 701, and an index

15   file (DCF file) is generated by the index generator 406

of the control section 119 on the basis of the contents

of the frame memory 701 at the end of motion video

shooting and recording.

The DCF file has the format of a still video file

20   normally used in a digital still camera, and can

contain a thumbnail image (160 × 120) in addition to

a main image. The index file can be recorded as a file

other than the encoded motion video file (ASF), or the

contents of the index file can also be contained in the

25   encoded motion video file (ASF). This state is shown

in FIG. 24. That is, ASF contains an index file

including a VGA-size still video and its thumbnail

image in addition to a motion video file including

a video and speech.

FIG. 25 shows the relationship between the motion

video shooting and recording timing and the index image

5    generation timing.

As shown in FIG. 25, when motion videos are shot

in an order of "motion video shooting A", "motion video

shooting B", and "motion video shooting C", an index

image a is generated from the first input frame (start

10   frame) during motion video shooting A, an index image b

is generated from the first input frame during motion

video shooting B, and an index image c is generated

from the first input frame during motion video shooting

C.  As shown in FIG. 26A, the motion video file A and

15   index a, the motion video file B and index b, and the

motion video file C and index c are recorded on the

recording medium.  The indices a, b, and c are used as

icons respectively representing the contents of the

motion video files A, B, and C, as shown in FIG. 26B,

20   or used to display a corresponding index image at the

beginning in reproducing a motion video file or display

an index image in order to confirm the contents of

a motion video file selected as a file to be deleted,

copied, moved, or the like.

25   The flow chart of FIG. 27 shows an index

image generation processing sequence by the control

section 119.

If video shooting/recording starts, the control section 119 saves the video signal of the first frame in the frame memory 701 (step S131). The control section 119 uses the MPEG4 encoder 201 to sequentially execute compression encoding of input motion video signals from the first frame until video shooting/ recording ends (steps S132 and S133). If video shooting/recording ends (YES in step S133), the control section 119 compression-encodes the frame images saved in the frame memory 701, and generates still index images (step S134).

<Communication Interface with personal computer>

A function of causing the personal computer 13 to recognize the video camera apparatus 11 as a storage device such as a hard disk in connection to the personal computer 13.

As shown in FIG. 28, the control section 119 comprises a USB driver 119a and ATA (AT Attachment) driver 119b. By executing these programs, the personal computer 13 can be caused to recognize the video camera apparatus 11 as an ATA hard disk device. In other words, when the video camera apparatus 11 is connected to the personal computer 13 via a USB interface, the personal computer 13 issues a request of acquiring the device type by a plug-and-play function, and the request is transferred to the ATA driver 119b via the USB interface 123 and USB driver 119a. Configuration

information representing that the video camera
apparatus 11 is an ATA hard disk device is sent back
to the personal computer 13 via the ATA driver 119b.
The ATA driver 119b controls the recording medium
5    (built-in flash memory 121 or PCMCIA card type hard
disk drive 122) in accordance with AT commands from the
personal computer 13.

If the PCMCIA card type hard disk drive 122 is not
mounted on the video camera apparatus 11, the personal
10   computer 13 is informed of property information such as
the memory capacity of the built-in flash memory 121,
and the file system of the personal computer 13 treats
the built-in flash memory 121 as an external hard disk
device.  The ATA driver 119b accesses the built-in
15   flash memory 121 in accordance with a read/write
request by an AT command from the personal computer 13.
Then, data such as a motion video file can be easily
exchanged between the video camera apparatus 11 and the
personal computer 13 by operation from the file system
20   of the personal computer 13.

If the PCMCIA card type hard disk drive 122 is
mounted on the video camera apparatus 11, the personal
computer 13 is informed of property information such as
the memory capacity of the PCMCIA card type hard disk
25   drive 122, and the file system of the personal computer
13 treats the PCMCIA card type hard disk drive 122 as
an external hard disk device.  The ATA driver 119b

accesses the PCMCIA card type hard disk drive 122 in
accordance with a read/write request by an AT command
from the personal computer 13. Then, data such as
a motion video file can be easily exchanged between

5    the video camera apparatus 11 and the personal computer
13 by operation from the file system of the personal
computer 13.

FIG. 29 shows the relationship between circuits
set in an ON state and circuits set in an OFF or

10   standby state when data such as a motion video file is
exchanged between the video camera apparatus 11 and the
personal computer 13.

When data such as a motion video file is exchanged
between the video camera apparatus 11 and the personal

15   computer 13, only circuits hatched in FIG. 29 operate.
This can minimize the power consumption of the video
camera apparatus 11 when connecting it to the personal
computer 13, and can prolong the usable time of the
video camera apparatus 11 serving as the storage device

20   of the personal computer 13.

The flow chart of FIG. 30 shows a processing
sequence by the control section 119 in connection to
the personal computer 13.

If the control section 119 detects connection to

25   the personal computer 13 via the USB interface 123 (YES
in step S141), the control section 119 checks whether
the PCMCIA card type hard disk drive 122 is mounted

(step S142).  If YES in step S142, the control section
119 sends back to the personal computer 13 a message
that the video camera apparatus 11 is a storage device
(PCMCIA card type hard disk drive 122), and informs the
5    personal computer 13 of property information of the
PCMCIA card type hard disk drive 122 or the like (step
S143).  If NO in step S142, the control section 119
sends back to the personal computer 13 a message that
the video camera apparatus 11 is a storage device
10   (built-in flash memory 121), and informs the personal
computer 13 of property information of the built-in
flash memory 121 or the like (step S144).  After that,
the control section 119 sets circuits not concerning
data transfer between the personal computer 13 and the
15   storage device in an OFF or standby state (step S145),
and accesses the built-in flash memory 121 or PCMCIA
card type hard disk drive 122 in this state in
accordance with a file access request from the personal
computer 13.

20   <Activation Processing>

        Processing performed by the control section 119
in turning on the video camera apparatus 11 will be
described with reference to the flow chart of FIG. 31.

        The control section 119 initializes each section
25   in the video camera apparatus 11, and checks during
initialization processing whether the PCMCIA card type
hard disk drive 122 is mounted or not (step S151).

If YES in step S151, the control section 119 selects
the PCMCIA card type hard disk drive 122 as a recording
medium for recording a motion video or still video file
obtained by video shooting (step S152). The default
5    motion video shooting and recording mode is set to,
e.g., FINE as a predetermined resolution in the VIDEO
mode (step S153). If NO in step S151, the control
section 119 selects the built-in flash memory 121 as
a recording medium for recording a motion video or
10   still video file obtained by video shooting (step
S154). The default motion video shooting and recording
mode is set to a mode at a lower bit rate than in the
use of the PCMCIA card type hard disk drive 122 as
a recording medium, e.g., NORMAL as a predetermined
15   resolution in the VIDEO mode, or to the INTERNET mode
(step S155). The target bit rate can be optimized by
automatically setting the default value of the target
bit rate in video shooting/recording in accordance with
the type of recording medium used.

20       As described above, this embodiment adopts a
method of compression-encoding a motion video signal
obtained by video shooting in accordance with the MPEG4
standard, and recording the encoded signal as a motion
video file. This embodiment can implement a video
25   camera highly compatible with a computer by setting
the Internet mode or the like.

      As has been described above, according to the

present invention, a video file compatible between the Internet and a computer can be obtained by video shooting.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.